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PCT/KR2004/002655

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Artcle 36 and Rule 70)

Applicant's or agent's file reference P04E5007PCT	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. **PCT/KR2004/002655**	International filing date *(day/month/year)* **15 OCTOBER 2004 (15.10.2004)**	Priority date *(day/month/year)* 16 OCTOBER 2003 (16.10.2003)

International Patent Classification (IPC) or national classification and IPC

H01B 1/24(2006.01)i, C08K 3/04(2006.01)i, G12B 17/02(2006.01)i, H05K 9/00(2006.01)i

Applicant

ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE et al

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ (sent to the applicant and to the International Bureau) a total of 2 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demamd	Date of completion of this report
28 APRIL 2005 (28.04.2005)	11 JANUARY 2006 (11.01.2006)
Name and mailing address of the IPEA/KR Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer KANG, SANG YOON Telephone No. 82-42-481-8153

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/KR2004/002655

Box No. I Basis of the report

1. With regard to the **language,** this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

   ☐ international search (under Rules 12.3 and 23.1(b))
   ☐ publication of the international application (under Rule 12.4)
   ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this reort as "originally filed" and are not annexed to this report):*

   ☐ the international application as originally filed/furnished

   ☒ the description:
   pages 1-13 as originally filed/furnished
   pages* _____ received by this Authority on _____
   pages* _____ received by this Authority on _____

   ☒ the claims:
   pages _____ as originally filed/furnished
   pages* _____ as amended (together with any statment) under Article 19
   pages* 14 & 15 received by this Authority on 1 August 2005
   pages* _____ received by this Authority on _____

   ☒ the drawings:
   pages 1/1 as originally filed/furnished
   pages* _____ received by this Authority on _____
   pages* _____ received by this Authority on _____

   ☐ the sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☒ The amendments have resulted in the cancellation of:

   ☐ the description, pages _____
   ☒ the claims, Nos. 2 & 8
   ☐ the drawings, sheets _____
   ☐ the sequence listing *(specify)* : _____
   ☐ any table(s) related to sequence listing *(specify)* : _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

   ☐ the description, pages _____
   ☐ the claims, Nos. _____
   ☐ the drawings, sheets _____
   ☐ the sequence listing *(specify)*: _____
   ☐ any table(s) related to sequence listing *(specify)* : _____

** If item 4 applies, some or all of those sheets may be marked "superseded."*

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	3-7, 9, 10	YES
	Claims	1	NO
Inventive step (IS)	Claims	None	YES
	Claims	1, 3-7, 9, 10	NO
Industrial applicability (IA)	Claims	1, 3-7, 9, 10	YES
	Claims	None	NO

2. Citations and explanations (Rule 70.7)

The written opinion of international search report is kept even for the amennded part or added claim. The range of carbon nano tube volume fraction and the range of metal powder volume fraction are imposed on the claim 1 comparing the originally filed claim 1. However, the range of volume fractions are still included as indicated in D1(JP 2002-290094) as CNT 0.~20wt% and conductive fiber or metallic fiber 5~50wt%. According to the communication with applicant, the volume fractions can be converted as CNT 0.096wt%~10.78wt% and silver powder 43.05wt%~81.82wt%.
Therefore, the previous written opinion is valid even after amendment as follow.

Reference is made to the following documents:
D1) JP 2002-290094 A
D2) US 6184280 B1

I-Novelty:

Claim 1 of the present invention is concerned with an electromagnetic wave shielding material comprising a polymer resin for a matrix and a conductive filler including a carbon nanotube and a metal. Reference D1 cited in the international search report discloses an electromagnetic wave shielding material comprising a thermoplastic resin material containing specified quantity of carbon nanotube and conductive fibers. Technical feature of claim 1 of the present invention is the same those of D1. Accordingly, the subject matter of claim 1 does not seem to be novel.(PCT Article 33(2)). However, dependent claims 3 to 7, 9, 10 seem to be novel as they specify element such as content or composition.

II-Inventive step:

1) Concerning claim 1 (Independent claim)
D1 cited in the international search report discloses a composition for electromagnetic wave shielding material. In particular, a variety of polymers for matrix and some conductive metals are described in D1. Even if the claim 1 refers to composite of polymeric matrix and conductive filler, material comprising polymer resin and conductive filler for electromagnetic wave shielding is obvious for the skilled person in the art. Therefore, claim 1 does not meet the criteria set out in PCT Article 33(3).
2) Concerning claims 3 to 7, 9, 10 (Dependent claims)
Although claims 3 to 7, 9, 10 specify element of polymeric matrix/conductive filler for shielding electromagnetic wave, adoption of polymer resin as a matrix and conductive metal is very easy to the skilled person in the art from the references D1 and D2. Therefore, claims 3 to 7, 9, 10 do not meet the criteria set out in PCT Article 33(3).
(to be continued on supplemental box)

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Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

Claims 1, 3 to 7, 9, 10 meet the criteria set out in PCT Article 33(4), because they are directed to an industrially applicable electromagnetic wave shielding material.

What is claimed is:

1. An electromagnetic shielding material comprising:

a polymer resin;

carbon nanotubes ranging from about 0.2 volume percent to about 10 volume percent; and

metal powder ranging from about 7.0 volume percent to about 30 volume percent and having an electrical conductivity of about 10^5 S/cm or more.

3. The electromagnetic shielding material as recited in claim 1, wherein the carbon nanotube employs a single-walled carbon nanotube or a multi-walled carbon nanotube.

4. The electromagnetic shielding material as recited in claim 1, wherein the carbon nanotube is manufactured by a method selected from the group consisting of a chemical vapor deposition, an arc discharge, a plasma torch and an ion impact.

5. The electromagnetic shielding material as recited in claim 1, wherein the carbon nanotube is material selected from the group consisting of a nanotube having a phenyl-carbonyl C-C stretch bonding peak existing between about 1,300 cm^{-1} and about 1,100 cm^{-1}, a nanotube having a phenyl-carbonyl C-C stretch bonding peak existing between about 1,300 cm^{-1} and about 1,100 cm^{-1}, a carbonic C-C stretch bonding peak existing between about 1,570 cm^{-1} and about 1,430 cm^{-1} and a carboxylic C=O stretch vibration peak existing at about 1,650 cm^{-1}, a nanotube having a phenyl-carbonyl C-C stretch bonding peak existing between about 1,300 cm^{-1} and about 1,100 cm^{-1}, a carboxyl C=O stretch vibration peak existing at about 1,650 cm^{-1} and an -OH bonding peak existing at about 3,550 cm^{-1}, a nanotube having a C-F bonding peak existing at about 1,250 cm^{-1} and a

combination thereof.

6. The electromagnetic shielding material as recited in claim 1, wherein the polymer resin is a general-purpose polymer selected from the group consisting of a silicon rubber, a polyurethane, a polycarbonate, a polymethyl methacrylate, polyvinyl alcohol, Acrylonitrile-Butadiene-Styrene terpolymer (ABS) and a combination thereof.

7. The electromagnetic shielding material as recited in claim 1, wherein the polymer resin is a thermosetting resin selected from the group consisting of epoxy, polyimide and a combination thereof.

9. The electromagnetic shielding material as recited in claim 1, wherein the metal is a material selected from the group consisting of a silver powder, a silver-coated copper powder, a steel fiber, a copper fiber, an aluminum fiber and a nickel fiber.

10. The electromagnetic shielding material as recited in claim 1, wherein a shielding effectiveness of the shielding material is equal to or more than 39dB when the shielding material is formed into a 0.5mm-thick board.